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Understanding the purchasing behaviour of a large academic institution and urban freight demand

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Abstract

Only in recent years has a conceptual model focussed on the 'receiver' end of the supply chain has been discussed amongst European urban freight researchers even though purchasing for large organisations does certainly have a documented and often regulated sustainability agenda. A localised city logistics Delivery Service Plan, within a 'coherent campus strategy' for an academic campus has been established at Newcastle University, located at the centre of a medium size British city. In order to better understand the relationships between delivery services, urban environment and staff attitudes, a questionnaire was conducted targeting Newcastle University staff, addressing the purchasing of all goods to be delivered at the work place. A high response rate led to new data on purchasing behaviour. Tentatively we would draw out that the qualitative surveys show willingness amongst the buying population to both suggest and embrace alternatives ideas. We can see that a very small core of people raise most of the orders, and as such it should be possible to influence the majority of orders through them.

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Keywords: purchasing behaviour; academic institution; freight delivery; empirical data

1. Introduction

Clean urban freight is a key European Union policy to both make cities environmentally sound, socially inclusive and economically viable as well as contributing to a 60% reduction of greenhouse gas emissions (GHG). Over 60%

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of the EU population currently lives in urban areas and contribute circa 85% of the GDP (European Commission 2007). The 2011 European Commission's Transport White Paper set ambitious scenarios and vision of the future urban freight transport "in order to halve the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; [and] achieve essentially CO2-free city logistics in major urban centres by 2030" (European Commission 2011). Some of the scenarios include minimising the number of freight movements and the distance required to carry them out; using low emission vehicles/trucks; and making maximum use of intelligent transport systems (ITS) to increase the efficiency of delivery.

However, these scenarios and most previous policy and research have focused on the operators of the transport chain and the shippers' (suppliers') initiatives. Only in recent years has a conceptual model focussed on the 'receiver' end of the supply chain has been discussed amongst European urban freight researchers (Verlinde et al. 2012; Browne et al. 2012; Zunder et al. 2014). A few examples have emerged of practical implementation of this approach, the most influential being the adoption of Delivery and Servicing Plans (DSP) as part of the London Freight Plan by the Transport for London (TfL), TfL's Palestra Offices in Southwark (Transport for London 2008) and consequent use in the 2012 Olympics. A DSP is the management and organisation of multiple operations of last mile deliveries from a demand based perspective optimised by efficient freight planning from the perspective of the receiving organisation (Zunder et al. 2014). It provides a framework to better manage freight movement by adjusting the conventional working methods of urban freight stakeholders to meet both the inbound logistics needs of the receiver and wider sustainability objectives. It may be more effective than previous interventions at the transport operator link in the chain since the delivery company is usually carrying out the expressed wishes of their customer, which is the supplier of goods or services in most cases. The supplier, in turn, is executing a supply to meet the expressed wishes of their client, usually the receiver. Whilst purchasing for large organisations does certainly have a documented and often regulated sustainability agenda (Hoejmose & Adrien-Kirby 2012; Walker & Brammer 2009), and Newcastle University does indeed have sustainability targets in the procurement policy, the relationship between institutional organisation and organisation as freight receiver bears further investigation.

The research questions we wish to raise about purchasing, formal and private, and inbound deliveries are multiple. For example, what are the drivers of purchasing, are they institutional, individual, corporate or even private demands using the workplace as an alternative delivery location? What are the key determinants of purchasing behaviour of a large institution, is it planned, ad hoc and to what extent is it for other users? Do different goods types noticeably create different demands? How is the required timing of demand for good generated versus the actual need for the goods? Do different goods types noticeably create different demands? How are goods delivered to the end user? To what extent has the coherent campus strategy effected change that is noticeable or memorable? How do people feel about purchasing, inbound deliveries, private purchasing at work, and freight in general? Is the changing behaviour of purchasing towards freight efficiency a feasible option for a sustainable institutional organisation? What is not clear, and which this research addresses in some part, is the degree to which that expressed demand is conscious or unconscious at the individual buyer level and the institutional level.

A localised city logistics DSP, within a 'coherent campus strategy' for an academic campus has been established at Newcastle University, located at the centre of a medium size British city across 500 square metres. As the second largest employer city in Newcastle upon Tyne, the campus services 5000 staff and 20,000 students. The site presents some of the research problems emergent in this field in that it is legally a single organisation and yet functionally it has many of the characteristics of a devolved and decentralised entity, or even entities. The University has over 80 buildings holding 144 schools/departments/institutes each of which can make a purchase order via 466 expert buyers and 1,058 shoppers. Initial analysis using secondary data of procurement data and traffic count has identified key facts about the freight activity and purchasing patterns but there is little clarity or understanding of the relationships between these activities (Zunder et al. 2012; Zunder et al. 2014).

This especially true when private purchasing takes place and the buying activity is invisible from the University oversight. As part of the broader background research and workshops, "straw polls" at forums and workshops, as well as anecdotal reports from TfL, have suggested that up to half of staff may have ordered personal goods and had them delivered to work. The University central mailroom has received dried food, motorcycle parts and a regular flow of goods from Amazon. This is not a confirmed fact since as a University almost all these items can have legitimate work purposes, and Amazon is an approved supplier.

This paper using a questionnaire survey methodology aims to gain a better understanding of the relationship between freight activity and purchasing both formal and private. The questionnaire was distributed via the Human Resources (HR) staff mailing list and the staff website. The design of questionnaire includes buying behaviour (e.g. frequency, time, type of product, value of goods), opinions on the University coherent campus strategy, environmental issues and socio-demographic characteristics. One of the hypotheses is that socio-demographic characteristics such as age, family size, job type and home location, are associated with the buying behaviour. A better understanding of this relationship would lead to the University to embrace a policy to reduce unexpected delivery to the campus site.

2. State of the art

Recent studies in addressing urban freight issues have highlighted the importance of the role of 'receiver' as opposed to 'carriers' in improving the sustainability of logistics supply chain. Since logistics is an induced activity and derives from purchases then sustainable purchasing is the pursuit of sustainable development objectives through the purchasing and supply chain process, incorporating social, environmental and economic aspects (Walker & Brammer 2009; Hoejmose & Adrien-Kirby 2012).

The strategic importance of the purchasing function in the business environment, notably in the private sector, has been acknowledged and recognised to contribute to economic advantages (Björklund 2011). Management, company image, customers, carriers and the public policies are some of the identified key drivers of sustainable purchasing within the private sector. Meanwhile within the public sectors' sustainable purchasing practices, factors such as environment, diversity, human rights, philanthropy and safety are key drivers to the sector (Walker & Brammer 2009). The identified key principles of public sector procurement are transparency, accountability, and achieving value for money for citizens and taxpayers.

A benchmarking exercise on improving sustainable purchasing practices within the private sector has demonstrated 11 key activities in engaging suppliers (Björklund 2010):

1) The use of Code of Conduct;
2) Internal training and education;
3) Integrate corporate social responsibility in management;
4) Report the corporate social responsibility performance;
5) Monitor suppliers;
6) Draw up improvement plans;
7) Reject suppliers;
8) Educate/inform/support suppliers;
9) Use rewards for compliance;
10) Supplier collaboration;
11) Restructure relationship.

The importance of training and education was highlighted in the private sector business practice (Björklund 2010), however, purchasing decision with regards to third party logistics (3PL) are still made mainly based on traditional criteria such as price, quality and timely delivery (Wolf & Seuring 2010). A study looking at the 3PL consideration on adopting green initiatives demonstrated that government support, management and the entrepreneurship are found to be the key drivers while well-defined regulations framework and financial incentives were the barriers (Evangelista 2014) and it is notable that the adoption of green public procurement has long been promoted within the EU (Day 2005).

A number of recent studies, mainly Swedish based, used the process approach to investigate the anticipated change. For example, the role of environmental (management) standard (i.e. ISO 14001) towards public sectors' sustainability agenda (Emilsson & Hjelm 2009); the role of stakeholders in shaping municipal energy and climate planning processes (Fenton et al. 2014a; 2014b); and the role of public procurement in setting up a coordinated freight distribution of municipal goods (Bjorklund & Gustafsson 2014).

Coordinated freight distribution as discussed in Bjorklund & Gustafsson (2014) is a new concept of city logistics that incorporated the use of an urban consolidation centre (UCC) in combination with other measures including the

promoted role of procurement function (of municipalities) to engage in-house operation of the last mile distribution and the use of smaller or clean energy vehicles. The impact to the procurement function is the potential change of contract cost and agreement between the public authorities and suppliers/service providers (3PL) as the product and logistic costs can be seen differently when last mile logistics was already done in-house (Moen 2014). While the importance of procurement function was highlighted to change the practice of purchasing on both sectors towards meeting the sustainability agenda at the institutional level, there is very little known of the purchasing behaviour at individual level within a large organisation. This paper just addresses that to gain better understanding of the mechanism of purchasing that influence delivery activity.

3. Methodology

In order to better understand the relationships between delivery services, urban environment and staff attitudes, a questionnaire was conducted in March 2014 targeting Newcastle University staff, addressing the purchasing of all goods to be delivered at the work place. The survey was designed, created and carried out using Surveymonkey in line with standard good practice with the use of the mailing lists held by HR but explicitly separate and distanced from the line management of staff. The completion of the questionnaire was voluntary but a random prize of a tablet was offered (and won) as an incentive to invite as many respondents as possible to complete the survey.

The design of the questionnaire included buying behaviour (e.g. frequency, time, type of product, value of goods), coherent campus strategy, environmental issues and socio-demographic characteristics. The objective of the design was to gain insights into how and why purchasing demand is generated so as to better understand inbound deliveries and achieving a sustainable campus environment as illustrated in Fig. 1.

Fig. 1. Illustration of possible key drivers of (private) purchasing behavior impact on urban freight activity.

There are four possible hypotheses posed to investigate the purchasing behaviour:

- H1 = purchasing behaviour, socio-demographic and environmental attitude are (indirectly) associated with freight activity;
- H2 = age, family size, job type and home location are associated with purchasing behaviour;
- H3 = car ownership, age, family size, job type and home location are associated with environmental attitude;
- H4 =environmental attitude is associated with purchasing behaviour.

The analysis in this paper focusses on the first hypothesis: purchasing behaviour, socio-demographic and environmental attitude are (indirectly) associated with freight activity.

4. Results

The purchasing function within the University is highly decentralised, with 466 expert buyers who would normally raise purchase order on behalf of a unit and a further 1,058 individual buyers (faculties/researchers/technicians/etc.) can also raise purchase orders. Although the questionnaire was sent to all staff within the University, circa 5,000 people, the realistic "buying" population are the expert buyers and individual buyers that totals 1,524. The total respondents who completed the survey were 735, so representing 18% of the staff and giving an appropriate population response rate of 48% responses (735/1524). The majority of the respondents (62%) are 'administrative and professional (e.g. library, clerical, administrative, managerial). This is followed with 11% 'specialist, technical and professional' (i.e. technicians); 10% academic – non-clinical; 7% research – non clinical; and others (10%) including: academic/research – clinical, teaching only, operational services, graduate or postgraduate students in residence.

With regards to the way purchase orders (POs) are made, 30% of the respondents reported never raising a PO while 50% of the respondents raise PO for another person. The dominant frequency of POs is once a fortnight or longer (64%) but the remainder of the respondents raise a PO at least once a week or more. About fifty (3.3%) staff raise orders at least once a day. While the majority of the respondents (64%) didn't order goods on repeating patterns, 32% of the respondents raised POs just before they run out of stock, and only very few respondents (1%) buying on a weekly repeating pattern. A qualitative analysis using cloud view text analysis, asking respondents on the reasons for when they made PO demonstrated that keywords such as 'Items', 'Needed' and 'Services' are the most noted by the respondents, especially the ones who reported a non- regular repeating patterns. This finding demonstrated that purchasing is not a methodical process but driven by unplanned (but perhaps forecastable) demands. The key characteristics of purchasing from Newcastle University staff can be seen in Table 1.

Table 1. Newcastle University staff majority purchasing characteristics.

	%	Key characteristics
Who - Job role	62	Administrative and professional (e.g. Library, Clerical, Administrative, Managerial)
Why - Purchase Order (PO) made	49	For goods and services for another person
How often - Frequency	64	Once a fortnight or longer
When - PO made	64	Not on regular repeating patterns
Where - delivery address	62	A building or department name
Purpose	81	Work related purchasing activity
Socio-demographic - gender	63	Female
Age	79	30-39 (29%); 40-49 (28%); 50-59 (22%)
Household size average	-	2.84
Location of work	21	King's Gate (main campus site)

4.1. Commodity types

Results of the commodities type purchased by the staff indicated that majority of the type or goods given in the survey were not relevant to majority of the respondents but typical commodities purchased can be summarised as can be seen in Table 2. The 'other' category includes equipment, external consumables, material items, services and training. Further scrutiny of the data demonstrates that the majority of the 'other' POs were non-delivery goods or services (37%), followed by laboratory/teaching consumables, domestic goods.

4.2. Expected delivery time

The majority of goods' deliveries were expected to be received 'as soon as possible' including the top commodities purchased as shown in Table 2: 'travel tickets or documentation', 'books, literature, etc.', 'repair or maintenance services', and 'ICT equipment. For 'catering', 'food and beverages' and 'furniture', the expected delivery were on

'specified date'. The only goods that have mostly 'next day' delivery expectations were 'office stationery' and 'travel tickets and documentation'. Goods with the lowest incidence of critical delivery time were 'books, literature, etc.' A significant number of responses indicated that 'office stationery' and 'ICT equipment' delivery time were not actually critical; which is a contradiction. It can be concluded that the characteristics of goods determine the way goods are expected to be delivered. Despite the expected delivery time characteristics drawn from the survey, it is notable that the University SAP ordering system defaults to 'next day delivery'. Although this by default system is somehow mirrored from the survey results that indicated the majority of the expected delivery time was 'as soon as possible', there are also goods that could potentially be regulated to achieve a coordinated delivery pattern.

Table 2. Typical purchase order (PO) of Newcastle University staff (N=507*)

Answer Options	% Responses	RANK
Travel tickets or documentation	59%	1
Catering (prepared food service)	46%	2
Office stationery	45%	3
Books, literature, videos, software, music (but not downloaded content)	42%	4
Repair or maintenance services	40%	5
ICT equipment (computers, printers, mice but not software)	37%	6
Other	27%	7
Laboratory consumables	25%	8
Food or beverages (non-service, as opposed to catering)	24%	9
Chemicals (hazardous or otherwise)	23%	10
Furniture	21%	11
Clinical or medical supplies (incl. biological reagents)	17%	12
Bulk gases, oils, fuels, etc.	8%	13

* Note: A number of respondents did not register their answers in the questionnaire because they do not normally raise purchase orders (PO)

4.3. Value of good ordered

The majority of the respondents reported that typical values of all type of goods were between £100-£499. The only reported type of goods that goes beyond that price was 'ICT equipment (computers, printers, etc.)' valued at between £500-£2499. The lowest value type of goods were represented by 'office stationery' and 'food or beverages (as opposed to catering)' with majority of the respondents reported less than £25 and between £25-£49 as the second group of majority. 'Repair or maintenance services' is the type of goods reportedly with unknown value by the majority of the respondents. This is followed by 'other' which are basically non-delivered goods or services above and 'furniture'.

4.4. How the goods are delivered

The majority of the goods (almost all type of goods categorised as can be seen in Table 2) were reportedly delivered in a box or boxes or trays that can be carried by a single person. Exceptions are on 'travel ticket or documentation' and 'books, literature, etc.' delivered in envelopes or packets. The respondents reported 77 different locations across the University buildings of where they work and these consequently more or less correspond to where the delivery of goods/ services could take place.

4.5. Private purchasing behaviour

Eighty-nine respondents (5.8% of the target population, maybe 1.7% of all staff) reported purchasing for personal needs delivered to the workplace. Typical of the majority of personal goods delivered to work place were 'books, literature, videos, software, music (but *not* downloaded content)', 'clothing', and 'travel tickets or documentation'. The frequency of private order made was typically less than twice a month. Some of the most reasons agreed by the respondents for why they did private purchasing were because 'there is no-one at home' and because 'travelling to collect failed delivery is inconvenient'. Some qualitative data reported by the respondents pointed to the fact that private purchasing is deemed unusual practice although some comments were made to illustrate the usefulness of being able to deliver private goods to work.

With regards to some qualitative remarks of the private purchasing activity, the respondents reported the importance of environmental awareness as the main driver to influence purchasing behaviour with the highest mean value as can be seen in Table 3. In contrast, less appreciation was given to the statement that conveys restriction on private purchasing activity to be delivered to work.

Table 3. Qualitative remarks re: private purchasing behaviour measured in the survey

	N	Min	Max	Mean	Std. Dev.
It is good that my workplace address is an address that I can rely on to have my personal purchase/order delivered.	448	1.00	4.00	2.8304	.81801
It is important to raise environmental awareness for every activity that we do (as part of the university), including purchasing/order.	455	1.00	4.00	3.0286	.61305
The environmental credentials of suppliers affects who I purchase services/goods from.	453	1.00	4.00	2.4216	.72939
When placing an order my choice is affected by how the goods will be delivered.	453	1.00	4.00	2.5519	.77293
I view the University more positively if they allow personal goods/services to come to my work address.	451	1.00	4.00	2.8670	.84855
The University should actively prevent all personal deliveries to work.	456	1.00	4.00	1.9123	.76531
It is important to allow personal deliveries at work in a way that minimises the impact of freight on campus.	455	1.00	4.00	2.9011	.68744

4.6. Coherent campus strategy

The survey asked the respondents a series of questions to judge the degree the University coherent campus strategy had led to noticeable or memorable change for staff. The respondents generally agreed that the campus has improved in the last 5 years in terms of consistency of signage, paving and landscaping; coherence – different spaces but a sense of unity; no through traffic; and slopes, no steps, on pedestrian walkways. The increased pedestrianization has also been noticed as creating less freight traffic (33% respondents) although the majority of the respondents (42%) didn't know if this is the case (note: a minority of University buildings are located not within the main campus location which has the biggest change in terms of pedestrianization following the coherent campus strategy).

4.7. Qualitative remarks: the survey resported by respondents

About over 80 qualitative responses were recorded in the survey. The main issues drawn from the qualitative remarks were twofold: the perception of staff that private purchasing delivered to work address as a restricted activity (Fig. 2); and the potential improvement the University can make with regards to reducing goods delivery to the University (Fig. 3).

5. Conclusion

This research is part of an on-going delivery and service plan intervention on a large academic institution, and as such it may be suitable as a case in itself and in comparison with other Universities or similar organisations. It probably does not inform the questions about shipper led interventions, or retailer led initiatives. As a large organisation with a sustainability agenda, it has a corporate interest that is not necessarily driven by bottom line cost imperatives. The survey carried out was intended to explore the degree to which institutional policy and actual purchasing behaviour are in alignment. This first survey and the preliminary analysis raise more questions than answers, but we can reach a few conclusions, albeit they will require further investigation.

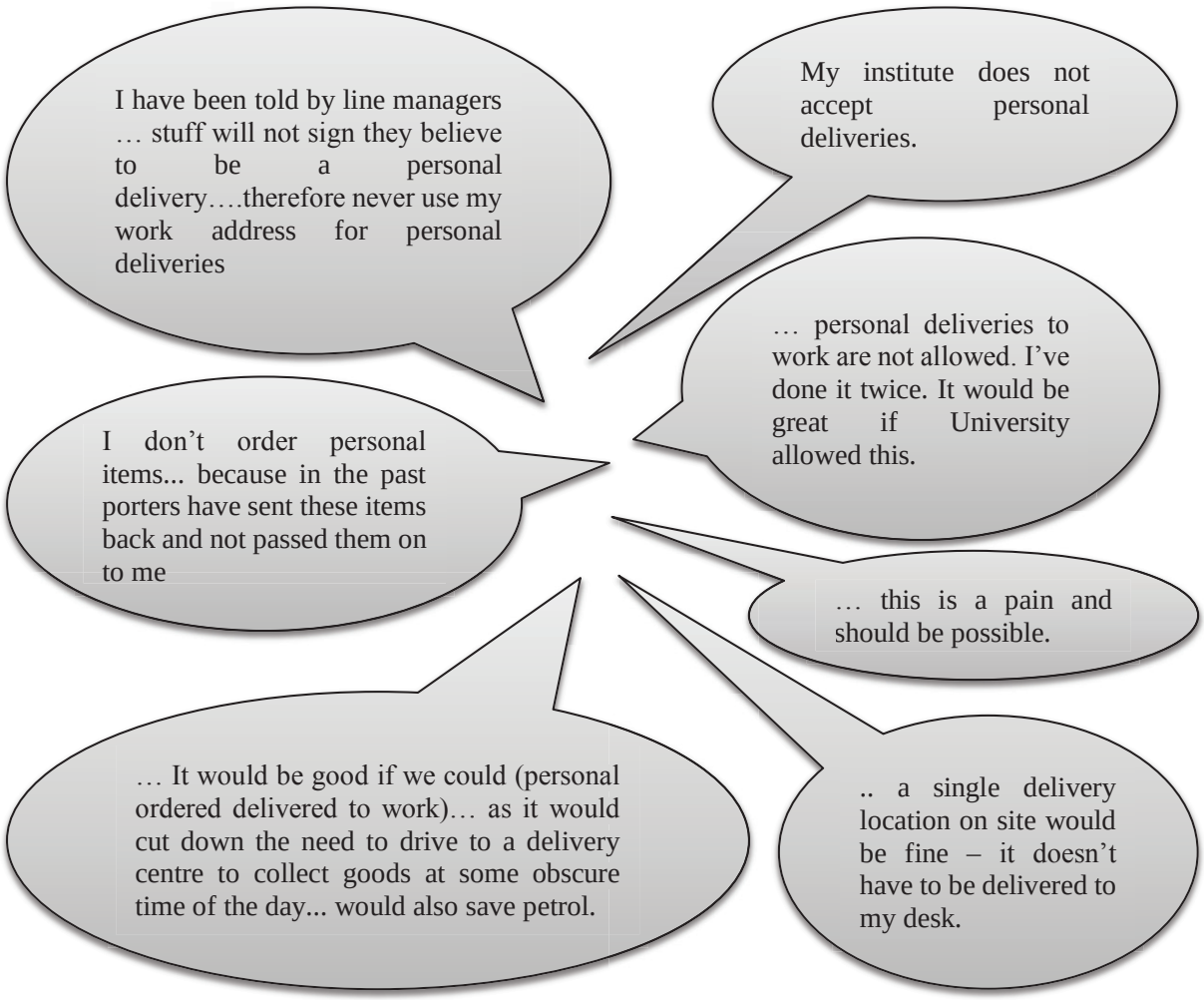

Fig. 2. Illustration of comments on the private purchasing delivered to workplace

We asked ourselves what are the drivers of purchasing, are they institutional, individual, corporate or even private demands using the workplace as an alternative delivery location? From the analysis we suggest that the majority of the purchasing demand created by the "buying" population at the University are created largely from formal institutional demand with a small core of buyers raising most of the orders, fifty (3.3%) in number, whereas the majority (64%) order once a fortnight or longer. Similarly only eighty nine (5.8%) of the buying population reported private purchases delivered to work, which may suggest that the anecdotal reports of high levels of informal

purchasing are not proven, or that the respondents are, by their nature and roles, more likely to follow the official disapproval of the practice. Given that the sample size is small and that it may be the wider population that generates private purchases an empirical survey may be a good verification tool for this result.

We asked what are the key determinants of purchasing behaviour of a large institution, and we can make some judgements here based on the purposes stated. Very few respondents have a weekly repeating pattern, with 32% ordering just as goods were needed, and 64% with no perceived patterns. This suggests that in most cases the demand is of the modern 'pull' basis and would generate 'just in time' demand on suppliers. We can also see that 49% of the population raise purchase orders for others, which is a derived demand, but also therefore another half are buying to meet their own workplace needs.

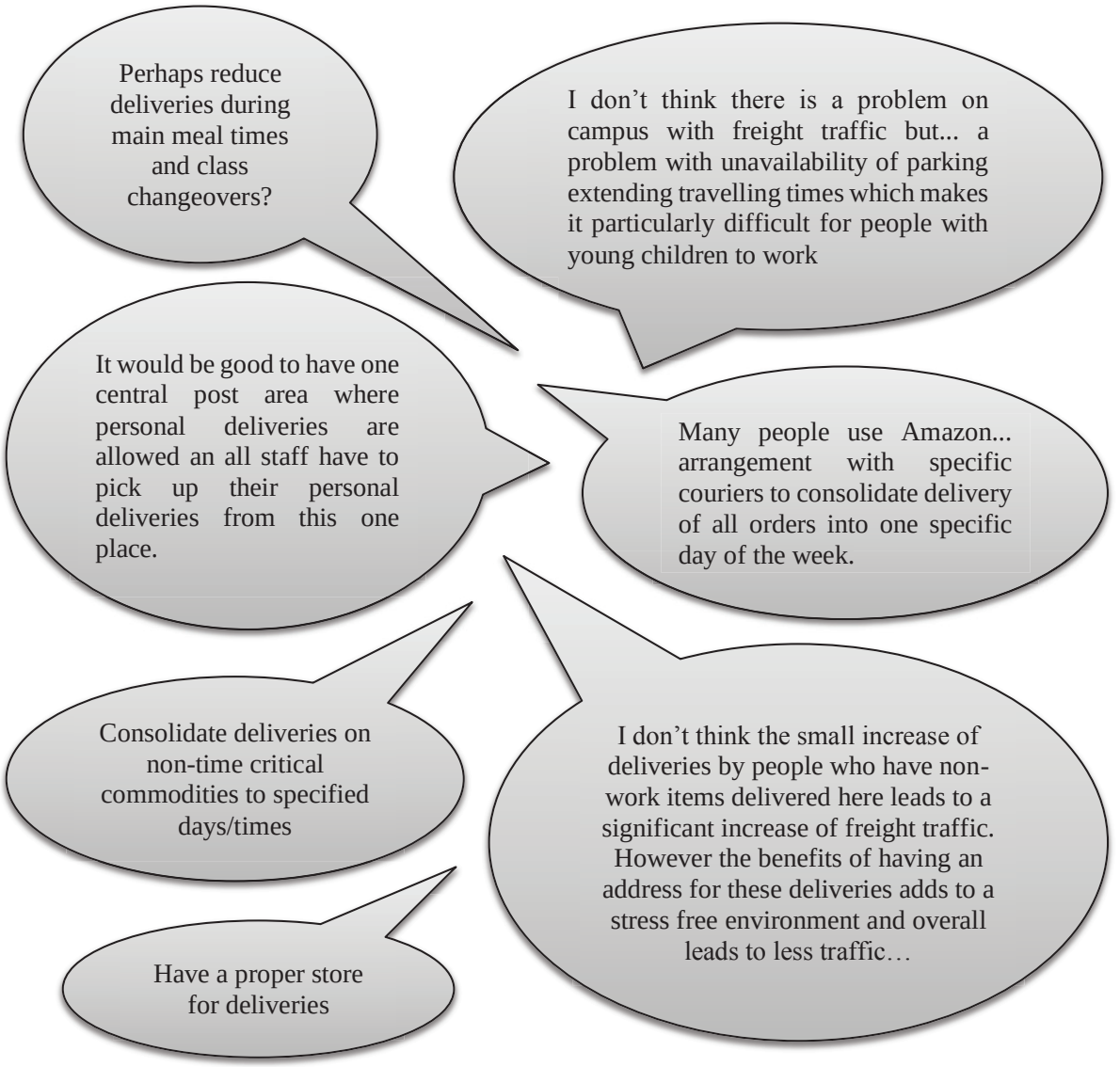

Fig. 3. Illustration of comments the impact of freight on campus

We asked how is the required timing of demand for good generated versus the actual need for the goods? We have already seen the ad hoc nature of ordering for most of the population, and combined with the expected delivery time

we can observe that the demand is being expressed as 'as soon as possible' or 'next day', with 'books, literature, etc.' having extended delivery expectations. Further analysis suggests that respondents have a contradictory view of the need for urgency on 'office stationery' and 'ICT equipment'. This, combined with the default next day delivery date on the University SAP ordering system suggests further exploration of the actual delivery requirements would merit investigation.

We asked if different goods types noticeably create different demands and how are goods delivered to the end user. Most goods ordered are delivered in boxes and trays, save for those delivered in envelopes and packets. This would suggest logistics delivery in small parcel vans and light goods vehicles, and indeed previous surveys have shown that 82% of all delivery vehicles to the campus are indeed light goods vans (Zunder et al. 2014)

The extent has the coherent campus strategy effected change that is noticeable or memorable is high, although 42% expressed no knowledge or opinion, a sizeable minority of 33% noticed that the pedestrianization had led to lower freight traffic. This needs unlocking a little further in future work since in fact traffic surveys show that in fact freight in absolute terms has been fairly static since 2012, and in percentage share has been rising. What we deduce is that since it is now limited in access, people perceive it less or simply find it less intrusive.

From qualitative analysis we can see that this 'buying' population feel that they should not buy private goods for workplace delivery but that it would be very helpful and welcomed. Those that have did so because ‘there is no-one at home’ and because ‘travelling to collect failed delivery is inconvenient’. The respondents also were well informed and made positive suggestions about improving freight deliveries, which shows that ideas for intervention in this area are widespread and not restricted to experts. We see this as confirmation that bottom up stakeholder led interventions have a strong body of innovative ideas to call upon.

We asked a very broad question: Is the changing behaviour of purchasing towards freight efficiency a feasible option for a sustainable institutional organisation, and we can only move ahead slightly with regard to that question. Tentatively we would draw out that the qualitative surveys show willingness amongst the buying population to both suggest and embrace alternatives ideas. We can see that a very small core of people raise most of the orders, and as such it should be possible to influence the majority of orders through them. On the other hand we should be concerned that the high frequency core orders may generate the most efficient inbound logistics and it may be the low repetition, low efficiency orders that should be addressed, a much wider pool of people for whom this is not a core activity.

5.1. Further research

The research will be further correlated with quantitative data to triangulate and verify the findings. We shall look to quantify the core 3.3% of buyers who raise most of the orders and correlate them to purchasing and delivery data from other research activities. This will then be integrated with the long time series of traffic surveys on campus, and will then be compared to interventions on-going with consolidation and already reported elsewhere (Zunder et al. 2012, Zunder et al. 2014, Leonardi et al. 2014).

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